

**Thoracic Trauma**  
**C168W014 / Version 1.1**  
**01 Jan 2010**

**SECTION I. ADMINISTRATIVE DATA**

<b>All Courses Including This Lesson</b>	<u>Course Number</u> 300-68W10	<u>Version</u> 2010	<u>Course Title</u> Health Care Specialist
<b>Task(s) Taught(*) or Supported</b>	<u>Task Number</u>	<u>Task Title</u>	
		<u>INDIVIDUAL</u>	
	081-833-0050 (*)	TREAT A CASUALTY WITH AN OPEN CHEST WOUND	
	081-833-3007 (*)	PERFORM NEEDLE CHEST DECOMPRESSION	
<b>Reinforced Task(s)</b>	<u>Task Number</u>	<u>Task Title</u>	
	081-833-0049	TREAT A CASUALTY WITH A CHEST INJURY	
	081-833-0213	PERFORM A TACTICAL CASUALTY ASSESSMENT	
<b>Academic Hours</b>	The academic hours required to teach this lesson are as follows:		
	<u>Resident Hours/Methods</u>		
	1 hr / Demonstration		
	1 hr 35 mins / Lecture		
	5 mins / Lecture		
	10 mins / Lecture and Demonstration		
	3 hrs / Practical Exercise (Hands-on)		
	0 hrs / Study Assignment		
Test	0 hrs		
Test Review	0 hrs		
	Total Hours:	6 hrs	
<b>Test Lesson Number</b>	<u>Hours</u>	<u>Lesson No.</u>	
	Testing (to include test review)	N/A	
<b>Prerequisite Lesson(s)</b>	<u>Lesson Number</u>	<u>Lesson Title</u>	
	None		
<b>Clearance Access</b>	Security Level: Unclassified Requirements: There are no clearance or access requirements for the lesson.		
<b>Foreign Disclosure Restrictions</b>	FD6. This product/publication has been reviewed by the product developers in coordination with the USAMEDDC&S foreign disclosure authority. This product is releasable to students from foreign countries on a case-by-case basis.		

**References**

<u>Number</u>	<u>Title</u>	<u>Date</u>	<u>Additional Information</u>
0-323-03986-3	PHTLS: Prehospital Trauma Life Support, 6th Edition	01 Jan 2007	
ISBN 0-07-065351-8	Emergency Medicine 5th Edition, Tintinalli, McGraw Hill	01 Jan 2000	
ISSN 0026-4075	Tactical Combat Casualty Care in Special Operations Supplement to Military Medicine Butler, Vol. 161, August 1996		

**Student Study Assignments**

None

**Instructor Requirements**

One 68W instructor per specified group

**Additional Support Personnel Requirements**

<u>Name</u>	<u>Stu Ratio</u>	<u>Qty</u>	<u>Man Hours</u>
None			

**Equipment Required for Instruction**

<u>Id Name</u>	<u>Stu Ratio</u>	<u>Instr Ratio</u>	<u>Spt</u>	<u>Qty</u>	<u>Exp</u>
6510-00-786-3736 PAD, ISOPROPYL ALCOHOL IMPREGNATE	1:50		No	0	Yes
6510-00-926-8884 ADHESIVE TAPE, SURGICAL	1:4		No	0	Yes
6510-01-549-0939 Bolin Chest Seal	2:1		No	0	Yes
6515-00-935-7138 SCISSORS, BANDAGE	1:1		No	0	No
6515-01-364-8553 GLOVE, PATIENT EXAMINING AND TREA	1:24		No	0	Yes
6515-01-364-8554 GLOVE, PATIENT EXAMINING AND TREA	1:34		No	0	Yes
6515-01-365-6183 GLOVE, PATIENT EXAMINING AND TREA	1:74		No	0	Yes
6515-01-466-0971 OXIMETER, PULSE	1:10		No	0	No
6515-01-532-8019 HYFIN CHEST SEAL	2:1		No	0	No
6515-01-541-0635 Needle Decompression Kit	4:1		No	0	Yes
6530-01-451-2958 CONTAINER, SHARPS	1:222		No	0	Yes
COMPUTER-INSTRUCTOR COMPUTER (CPU) WITH KEYBOARD, INSTRUCTOR USE ONLY	1:60		No	0	No
MONITOR-INSTRUCTOR COMPUTER MONITOR	1:60		No	0	No
PROJECTOR-INSTRUCTOR OVERHEAD PROJECTOR WITH COMPUTER INTERFACE	1:30		No	0	No
SCREEN-INSTRUCTOR SCREEN PROJECTOR, INSTRUCTOR USE	1:30		No	0	No
TENSION MANIKIN TENSION PNEUMOTHORAX MANIKIN	1:6		No	0	No
VCR-INSTRUCTOR	1:60		No	0	No

**Materials  
Required****Instructor Materials:****Student Materials:**

Student handout LP C168W014

The AMEDD Virtual Library: <https://medlinet.amedd.army.mil/>**Classroom,  
Training Area,  
and Range  
Requirements**CLASSROOM, L1, 1881.81SF, 60PN (68W)  
MULTI-SKILLS, 1240.85SF, 48/8PN (68W)**Ammunition  
Requirements**

<u>Id</u>	<u>Name</u>	<u>Exp</u>	<u>Stu Ratio</u>	<u>Instr Ratio</u>	<u>Spt Qty</u>
None					

**Instructional  
Guidance****NOTE:** Before presenting this lesson, instructors must thoroughly prepare by studying this lesson and identified reference material.**Demonstrations** - All demonstrations will be delivered by way of the "whole-part-whole" technique. The instructor demonstrates the skill three times, in a row, to students, before students practice the directed task:

1. Whole. The instructor demonstrates the entire skill from beginning to end, while briefly naming each action or step. If possible, the skill should be performed under the condition specified in standard.

2. Part. The instructor demonstrates the skill again step-by-step, explaining each part in detail. It is important that the instructor select proper size "bites" of the skill. If the information is too specific, the learner can be overloaded with detail. Too broad and the learner may not be able to make the connection from step to step.

3. Whole. The instructor demonstrates the entire skill from beginning to end without interruption, and usually, without commentary. If possible, as the skill would normally be completed "on the job".

**Practical Exercises** - All practical exercises associated with this block of instruction, will in delivered in sessions with groups.**Sessions:**Imitation Sessions

Similar to "by-the-numbers". Group includes a Medic, an Evaluator, w/manikin  
Process: 1) Instructor reads a step in the task, 2) Medic performs it, 3) Instructor reads the next step, 4) This continues until the task is complete  
Why? The first time a task must be completed correctly. Learn it right the first time.

Manipulation Sessions

Peer-guided training. Group includes Medic, Patient, Evaluator, Reader, Assistant  
Process: 1) Reader recites steps, 2) Medic & Assistant perform skill on patient, 3) Evaluator provides critique  
Why? Exploits the group dynamic & develops "muscle memory"

Precision Sessions

Peer-guided training. Group includes: Medic, Patient, Evaluator, Reader, Assistant  
Process: 1) Complexity is added, 2) Reader recites steps, 3) Medic & Assistant perform skill on patient, 4) Evaluator provides critique  
Why? Develops "muscle memory" & stress inoculates

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**Group Roles and Responsibilities**

**Medic** – primary skill performer, may be individual or a team leader

**Patient** – Portrays signs and symptoms according to the scenario provided.

**Evaluator** – Uses a skill sheet and records steps as they are performed.

**Reader** – verbalizes each step to the medic in **Manipulation** and **Precision**

**Sessions**

**CLS** – performs care as directed by the **Medic**

**Proponent  
Lesson Plan  
Approvals**

<u>Name</u>	<u>Rank</u>	<u>Position</u>	<u>Date</u>
Hansen, Meredith	YC-02	Chief, Curriculum Development	01 Nov 2009
Walker, Barbara	GS-12	ISS	01 Nov 2009

**SECTION II. INTRODUCTION**

Method of Instruction: <u>Lecture</u>
Instructor to Student Ratio is: <u>1:60</u>
Time of Instruction: <u>5 mins</u>
Media: <u>Large Group Instruction</u>

**Motivator**

Many casualties with multiple injuries will have an associated chest injury. Severe thoracic injuries may result from vehicle accidents, falls, gunshot wounds, fragmentation wounds, crush injuries, stab wound, and/or burn injuries. In combat, penetrating chest wounds are a frequent cause of mortality on the battlefield. The combat medic must be familiar with the proper treatment of, stabilization of, and evacuation of Soldiers with associated chest trauma.

**Terminal  
Learning  
Objective**

**NOTE:** Inform the students of the following Terminal Learning Objective requirements.

At the completion of this lesson, you [the student] will:

<b>Action:</b>	Treat the thoracic injury
<b>Conditions:</b>	Given a combat casualty with a suspected thoracic injury
<b>Standards:</b>	IAW the principles of Tactical Combat Casualty Care and Pre-Hospital Trauma Life Support Chapter 10 and 21.

**Safety  
Requirements**

None

**Risk  
Assessment  
Level**

Low

**Environmental  
Considerations**

**NOTE:** It is the responsibility of all Soldiers and DA civilians to protect the environment from damage.

**Evaluation**

Students will be given a one hour written examination for this module, to include Thoracic Trauma. Students must also demonstrate knowledge and skills in the practical exercise.

**Instructional  
Lead-In**

Knowledge of the anatomy of the thoracic cavity is essential when planning for chest trauma. You must recognize the signs and symptoms of major thoracic injuries and provide appropriate care. Open chest injuries can be the result of a motor vehicle accident, a bullet, fragmentation, falls, or a blow. These injuries are serious and, unless treated rapidly and correctly, can result in severe morbidity and mortality.

### SECTION III. PRESENTATION

**NOTE:** Inform the students of the Enabling Learning Objective requirements.

**A. ENABLING LEARNING OBJECTIVE**

<b>ACTION:</b>	Assess for a thoracic injury
<b>CONDITIONS:</b>	Given a combat casualty with a thoracic injury
<b>STANDARDS:</b>	IAW the standards of Tactical Combat Casualty Care and Prehospital Trauma Life Support Chapter 10

1. Learning Step / Activity 1. Anatomy and Physiology Review of the Thorax

Method of Instruction: Lecture  
Instructor to Student Ratio: 1:60  
Time of Instruction: 5 mins  
Media: Large Group Instruction

a. Review anatomy

(1) Bones

(a) Clavicles

(b) Scapula

(c) Ribs - twelve pairs of ribs attach to twelve thoracic vertebrae of the spine

1) Ten of the twelve pairs of ribs attached to sternum

2) Two are floating ribs (connected by cartilage to the sternum)

(2) Organs of the thorax

(a) Heart

(b) Trachea

(c) Bronchi

(d) Lungs

(e) Mediastinum - cavity between lungs, contains heart and great vessels

(f) Major blood vessels

1) Pulmonary artery and vein

2) Aorta

3) Inferior and superior Vena Cava

(3) Upper abdominal organs are also protected by the lower rib cage

(a) Spleen

(b) Kidneys

(c) Liver

- (d) Stomach
- (e) Pancreas
- (f) Intestines

(4) Muscles within the thorax

- (a) Intercostal muscles between adjacent ribs that function as secondary muscles of respiration.
- (b) Diaphragm - a musclobfibrous partition separating the thoracic and abdominal cavities, which will vary in location based on phase of respiration (inspiration lower and expiration higher.)

(6) Pleura

- (a) Visceral pleura - membrane attached to the surface of the lung
- (b) Parietal pleura - membrane attached to the surface of the chest wall
- (c) Pleural fluid
  - 1) Lubricating fluid between the visceral and parietal pleura
  - 2) Surface tension created by the pleural fluid leads to unification of the chest wall and the lung surface.
  - 3) The chest wall transmits pressure through the pleural surfaces and fluid to the lungs.

b. Review Physiology of Breathing

(1) Inhalation

- (a) Diaphragm and intercostal muscles contract
- (b) Lungs expand
- (c) Intrathoracic air pressure decreases below atmospheric air pressure
- (d) Air moves from area of more pressure (outside air) to less pressure (inside lungs)

(2) Exhalation

- (a) Diaphragm and intercostal muscles relax
- (b) Chest wall exerts pressure against the lungs
- (c) Intrathoracic pressure increases above the atmospheric air pressure
- (c) Air moves from area of more pressure (inside lungs) to less pressure (outside air)

2. Learning Step / Activity 2. Determine Mechanism of Injury

Method of Instruction: Lecture  
 Instructor to Student Ratio: 1:60  
 Time of Instruction: 5 mins  
 Media: Large Group Instruction

a. Mechanism of Injury

- (1) Thoracic injuries may be the result of penetrating or blunt trauma

- (2) A penetrating thoracic wound at the fourth intercostal space (level of the nipples) or lower should be assumed to be an abdominal injury as well as thoracic injury (diaphragm higher in expiration).
- (3) A penetrating abdominal wound above the level of the umbilicus may be a thoracic injury (diaphragm lower in inhalation).
- (4) The trajectory of a bullet can be unpredictable.
  - (a) Once inside of the body they do not always follow a straight line.
  - (b) All thoracic and abdominal structures are at risk

b. Penetrating trauma

- (1) Gunshot, fragmentation or stab wounds
- (2) Distribute forces of injury over a smaller area

c. Blunt trauma

- (1) Force is distributed over a larger area
- (2) May occur from:
  - (a) Deceleration (sudden stops, falls, MVA, airplane crashes)
  - (b) Compression (crush injuries)
  - (c) Bursting or sheering forces (traumatic rupture of the aorta, MVA, falls from great height)

d. Chest Trauma on the Battlefield

**NOTE:** Decreased thoracic injuries on the battlefield are directly related to improvements in today's personal protective equipment and tactical medical training. However, the identification, assessment, and monitoring of these types of injuries in combat can be a challenge for medics. Nevertheless, tactical field interventions are straight forward.

(1) Hemorrhagic Sources

- (a) Heart and/or associated vessels in the thoracic cavity
- (b) In most cases, surgery must be imminent to save casualty or the outcome is often fatal
- (c) Injuries include:
  - 1) Cardiac contusion
  - 2) Penetrating wounds to the heart or blood vessels
  - 3) Pericardial tamponade
  - 4) Hemothorax

(2) Pneumothorax – due to penetrating or blunt trauma

- (a) Penetrating (open) wound – projectile enters chest allows air enters pleural space
- (b) Blunt (closed) trauma – tear in visceral pleura allows air enters pleural space

(3) Tension Pneumothorax

- (a) Injury forms one-way valve & only lets air IN pleural space
- (b) Air builds up pressure & prevents heart from filling/pumping and compresses the other lung

(4) Other sources of chest trauma

- (a) Diaphragmatic Tears
- (b) Simple Rib Fractures
- (c) Flail Chest
- (d) Traumatic Asphyxia
- (e) Tracheal Bronchial Tree Injury

3. Learning Step / Activity 3. Assess a Casualty

Method of Instruction: Lecture  
 Instructor to Student Ratio: 1:60  
 Time of Instruction: 20 mins  
 Media: Large Group Instruction

a. Care under Fire - Move the casualty to cover.

- (1) Blunt or penetrating trauma to the chest are best deferred to the Tactical Field Care phase.
- (2) If necessary, casualty should be directed to perform self aid/buddy aid until the tactical situation allows for medical care.
- (3) Something as simple as a hand placed over an open chest wound can slow or stop the progression of the injury.

b. Tactical Field Care

- (1) Take BSI precautions, if possible.
- (2) Assess the casualty's level of responsiveness and chief complaint.
- (3) Perform a blood sweep of the extremities, neck, axillary and inguinal areas
- (4) Assess and manage the airway
- (5) Assess and manage breathing
  - (a) Remove the casualty's equipment, open the IBA and expose the torso
  - (b) Assess breathing for:
    - 1) Equal rise and fall of the chest
    - 2) Spontaneous respiratory effort.
    - 3) Pulse oximeter reading, if available.
  - (c) Inspect and palpate the anterior and posterior chest wall
  - (d) Manage chest wounds, if present.
  - (e) Monitors casualty's respiratory effort (ease of respiration).



(f) Position casualty to facilitate respiratory effort.

c. Signs indicative of chest injury may include:

(1) Blood pressure (Not possible during care under fire phase, use palpable pressure assessment until further security provided)

(a) Hypertension

(b) Hypotension

(2) Respiratory rate and effort - Evidence of respiratory distress

(a) Tachypnea (rapid respiratory rate)

(b) Bradypnea (slow respiratory rate)

(c) Labored breathing

(d) Retractions (utilizing accessory muscles to assist breathing)

(e) Hemoptysis (coughing up blood)

(f) One or two word sentences

(g) Agitation or air hunger

(3) Skin

(a) Diaphoresis - secretion of sweat

(b) Pallor - absence of color

(c) Cyanosis (skin, lips, fingertips, nailbeds)

(4) Neck

(a) Position of trachea - deviated

(b) Subcutaneous emphysema: Air or gas present in the subcutaneous layer of skin.

(c) Jugular venous distension

(d) Penetrating wounds

(5) Chest

(a) Contusions

(b) Tenderness

(c) Asymmetry

(d) Open wounds or impaled objects

(e) Crepitation

(f) Flail Chest or paradoxical movement (opposite from the rest of the chest)

(g) Lung sounds

- 1) Absent or decreased
  - 2) Unilateral or bilateral
  - 3) Bowel sounds in lung area (ruptured diaphragm).
- (h) Heart sounds: muffled or distant

## CHECK ON YOUR LEARNING

While assessing a casualty, what clues would indicate that a thoracic injury is getting worse?

How should thoracic injuries be dealt with during Care under Fire?

During what part of your assessment should you assess for and treat thoracic injuries? Why?

### B. ENABLING LEARNING OBJECTIVE

<b>ACTION:</b>	Treat a casualty with an open chest injury
<b>CONDITIONS:</b>	Given a combat casualty
<b>STANDARDS:</b>	IAW the principles of Tactical Combat Casualty Care and Prehospital Trauma Life Support Chapter 10 and 21.

#### 1. Learning Step / Activity 1. Pneumothorax

Method of Instruction: Lecture  
 Instructor to Student Ratio: 1:60  
 Time of Instruction: 15 mins  
 Media: Large Group Instruction

##### a. Pneumothorax (commonly referred to as either simple or closed)

- (1) Caused by an accumulation of air within the potential space between the visceral and parietal pleura.
  - (a) The intercostal muscles contract moving the rib cage up and out while the diaphragm contracts moving downward.
  - (b) Due to an imperfection, the surface tension between the two pleura is not maintained and a small amount of air enters the space.
  - (c) Entering air will occupy the space that would normally be occupied with expanding lung tissue.
  - (d) Less expansion of the lung equals less available space for gas exchange.
  - (e) Oxygenation of the blood is reduced, carbon dioxide is not removed, ventilation is impaired and hypoxia results.
- (2) Causes
  - (a) Blunt trauma
  - (b) Occasionally a pneumothorax will occur for no apparent reason (spontaneous), usually seen in tall slender males that are smokers.
- (3) A simple/closed pneumothorax is not in and of itself life-threatening. The concern is that the simple pneumothorax will progress to a tension pneumothorax (discussed later).

- (a) Casualty will complain of pleuritic chest pain and exhibit signs and symptoms of respiratory distress.
- (b) In this injury, auscultation over the apices of the lungs is more likely to demonstrate decreased breath sounds than the mid lung fields. This is extremely hard to detect during the noise of battle.

b. Open pneumothorax

- (1) Caused by penetrating thoracic injury.
- (2) If the open wound is large enough, 2/3 the size of the trachea, it will present with a sucking sound and is commonly referred to as a sucking chest wound.
  - (a) The trachea in an adult is around 1 inch (2.5 cm) in diameter.
  - (b) Males have wider tracheas than females.
- (3) The pathophysiology of a closed pneumothorax and open pneumothorax are the same, air accumulates within the potential space of the pleural cavity.
- (4) To suffer exclusively from an open pneumothorax is rare.
  - (a) A penetrating object to the chest will sever vessels and cause bleeding.
  - (b) You should assume the wounds encountered are some variation of a hemothorax and pneumothorax (hemo/pneumo).
- (5) If one wound is found, **ALWAYS** assess for multiple wounds and an exit wound.

c. Management

- (1) Follow assessment protocols (hemorrhage, airway and breathing) based on the environment in which care is provided (tactical field care).
  - (a) Do not get tunnel vision on injuries to the thorax.
  - (b) Because of the increase of blast and ballistic injuries in a combat environment, early recognition of pneumothorax, careful monitoring and aggressive interventions will directly result in lives saved on the battlefield.
- (2) As soon as an open wound to the thorax is identified:
  - (a) Quickly close chest wall defect with an occlusive dressing. First wound found is the first wound treated.
  - (b) Tape all four sides of the improvised occlusive dressing to ensure a proper seal and to avoid the dressing becoming loose during transport of the casualty or place a commercial chest seal.
  - (c) Assess for any additional wounds and treat immediately with an occlusive dressing
  - (d) Continuously monitor the casualty's respiratory effort looking for signs of progressive respiratory distress. This is a sign of a life-threatening injury (tension pneumothorax).
- (3) Assess the patient for evidence of shock per the tenets of TC3 (discussed later).
- (4) Transport to nearest treatment facility
  - (a) If the casualty is able, transport casualty in position of comfort. For conscious casualties, that normally means sitting up.

- (b) If casualty is unable, transport casualty on his side or recovery position with injured side down.
- (5) Provide, if available:
  - (a) Pulse oximetry
  - (b) High flow oxygen
  - (c) Cardiac monitoring
- (6) Once the casualty arrives at a higher level of care a medical officer may decide a chest tube is necessary.

## CHECK ON YOUR LEARNING

What is a pneumothorax?

Your casualty has a thoracic entrance and exit wound. In what order should the wounds be covered?

What is the difference between an open pneumothorax and a sucking chest wound?

What is the definitive treatment for a pneumothorax?

What other problems will complicate a pneumothorax?

What type of pneumothorax is the most immediately life-threatening and why?

### 2. Learning Step / Activity 2. Occlusive Dressings

Method of Instruction: Lecture and Demonstration  
Instructor to Student Ratio: 1:60  
Time of Instruction: 10 mins  
Media: Large Group Instruction

#### a. Common properties

- (1) Air tight. Made from any nonporous material
- (2) Sterile or non-sterile. The critical action is to seal the wound.
- (3) Large enough in size, when compared to the wound, it extends past the edges of the wound approximately 2 inches.

#### b. Vents

**NOTE:** No medical study has determined that an occlusive dressing should contain a one way valve or vent.

##### (1) Unvented Occlusive Dressings

- (a) Seals the wound preventing air from **exiting OR entering** the pleural cavity
- (b) No breaks in the continuity of the dressing.

##### (2) Vented Occlusive Dressings

- (a) Seals the wound preventing air from **entering** the pleura

- (b) Vents are designed to allow air movement in only one direction (one way valve. Air can escape out of the pleural space through the valve, but air cannot re-enter the pleural space through the valve.

c. Securing the dressing to the casualty

**NOTE:** Blood, sweat and dirt can cause adhesive and tape not to perform as intended. Always consider a gross cleaning of the area before applying and securing the dressings.

- (1) Many commercial dressings contain adhesive material incorporated on the dressing.
  - (a) If the commercial dressing properly adheres to the chest, securing with additional tape is not necessary.
  - (b) If the area around the wound is especially bloody, sweaty or dirty and the dressing does not adhere to the chest, reinforce with tape on all four sides.
  - (c) Dressing should extend at least 2" beyond all edges of the wound
  - (d) If the casualty is especially hairy, shave or use tape to remove hair, allowing the dressing to fully seal to the wound.
- (2) Improvised occlusive dressings (without adhesive)
  - (a) Must be secured to the casualty with tape on four sides.
  - (a) Tape should extend at least 2" beyond all edges of the wound.

## CHECK ON YOUR LEARNING

Look around you classroom. Write down some examples of items you could use as an improvised occlusive dressing. (Find a minimum of 5.)

Are vents a requirement for an effective occlusive dressing? Why or why not?

How many side of an improvised occlusive dressing are taped to the casualty? What if the piece of material that you use as an occlusive dressing is circular?

### 3. Learning Step / Activity 3. Apply an Occlusive Dressing - Demonstration

Method of Instruction: Demonstration  
Instructor to Student Ratio: 1:15  
Time of Instruction: 25 mins  
Media: Large Group Instruction

The class is broken down into 4 groups. One instructor will lead one group through demonstration of the task 3 times in a row using the "Whole-Part-Whole" method. Please refer the Instructor Guidance section for additional information.

#### Reference: DCMT approved Occlusive Dressing skill sheet

### 4. Learning Step / Activity 4. Apply an Occlusive Dressing - Practical Exercise

Method of Instruction: Practical Exercise (Hands-on)  
Instructor to Student Ratio: 1:6  
Time of Instruction: 1 hr 25 mins  
Media: Large Group Instruction

Combat Casualty Assessment scenarios are not used during this initial phase of skill training. Information below contains training minimums, additional sessions should be conducted based on the needs of the students. See Instructor Guidance for additional information. For all aspects of this practical exercise, student groups will be utilized.

- a. Imitation Session - no less than one imitation session per student
- b. Manipulation Session - no less than two manipulations session per student.
- c. Precision Session - The following drills may be completed based on the time allotted. A minimum of one precision session should be completed per student.
  1. Speed drills
  2. Low light skill attempts
  3. Blind folded intervention attempts

### C. ENABLING LEARNING OBJECTIVE

<b>ACTION:</b>	Perform needle chest decompression
<b>CONDITIONS:</b>	Given a casualty with penetrating trauma to the thorax and progressive respiratory distress
<b>STANDARDS:</b>	Safely, IAW the principles of tactical combat casualty care and Prehospital Trauma Life Support Chapter 21.

### 1. Learning Step / Activity 1. Tension Pneumothorax

Method of Instruction: Lecture  
Instructor to Student Ratio: 1:60  
Time of Instruction: 25 mins  
Media: Large Group Instruction

#### a. Events leading to a tension pneumothorax

- (1) Any open pneumothorax should be immediately turned into a closed pneumothorax with the application of an occlusive dressing. (**ALWAYS** check for an multiple wounds or an exit wound)
- (2) If air continues to enter the pleural cavity pressure will build inside the pleural space compressing the internal structure of the chest.
- (3) Statistics demonstrate preventable combat fatalities were due to a tension pneumothorax.

b. Pathophysiology of a tension pneumothorax

- (1) Occurs when a one way valve is created from either penetrating or blunt trauma. May also occur with the application of an occlusive dressing on an open chest wound.
- (2) Air cannot leave plural space.
- (3) Pressure develops and increases within the pleural space.
- (4) The lung cannot expand. Gas exchanged in the injured lung is compromised.
- (5) As pressure continues to build, it causes further compression of affected lung.
- (6) The pressure pushes the mediastinum to the opposite side of the injury.
- (7) As the mediastinum shifts, pressure is applied to the major vessels (vena cava), the heart and uninjured (good) lung.
  - (a) There is no gas exchange in the injured (collapsed) lung.
  - (b) Gas exchange of the uninjured (good) lung is compromised.
  - (c) Ventilation is significantly affected.
  - (d) Pressure against the mediastinum prevents the heart from filling with blood. If the heart cannot fill with blood, blood cannot be pumped effectively and cardiac output decreases.
- (8) If tension is allowed to build, circulation, respiration and gas exchange will be compromised. The casualty will die.

c. Signs and Symptoms include:

- (1) Anxiety, apprehension, agitation
- (2) Diminished or absent breath sounds
- (3) Progressive respiratory distress.
- (4) Tachypnea (rapid respiratory rate)
- (5) Hypotension, cold clammy skin, patient begins to rapidly deteriorate
- (6) Distended neck veins (may not be present in a hemothorax) and cyanosis
- (7) The development of decreased lung compliance in intubated casualty should alert you to the possibility of tension pneumothorax. (The BVM will be harder to compress.)
- (8) Tracheal deviation (late finding)

d. Combat Considerations for a Tension Pneumothorax

- (1) The above signs and symptoms may be difficult to assess in a combat situation.
- (2) Intervention indications for tension pneumothorax include only the following:
  - (a) Unilateral penetrating torso injury (previously treated appropriately)
  - (b) Development of progressive respiratory distress which may take minutes or hours.

e. Management

- (1) Follow assessment protocols (hemorrhage, airway and breathing) based on the environment in which care is provided.
- (2) Treatment of progressive respiratory distress in a combat environment is best deferred to the tactical field care phase.
- (3) As soon as an open wound to the thorax is identified, apply occlusive dressings:
- (4) Continue with assessment protocols and constantly monitor the casualty for progressive respiratory distress. If the patient meets **BOTH** of the following criteria, treat for a tension pneumothorax:
  - (a) Unilateral penetrating torso injury (previously treated appropriately)
  - (b) Progressive respiratory distress
- (5) Needle Chest Decompression (NCD)
  - (a) A needle placed into the compromised pleural space that allows the trapped/accumulated air under pressure to escape.
    - 1) NCD does not "re-inflate" the lung like a sponge.
    - 2) NCD alleviates the tension (or pressure) being placed on the lungs and mediastinum. The internal anatomy returns to normal and allows blood flow to the heart. The good lung can fully expand.
    - 3) NCD is a stop gap measure for tension pneumothorax until the casualty arrives at the MTF.
      - a) The casualty requires evaluation from a medical officer.
      - b) Definitive care for a tension pneumothorax includes a chest tube.
      - c) Based on the extent of the internal, damage surgical intervention may be necessary.
  - (b) Equipment
    - 1) 14 gauge needle and catheter, 3.25 inches in length
      - a) 14 is the smallest gauge needle that should be attempted.
      - b) A 3.25 inch length catheter is necessary to penetrate through the chest wall, enter the pleural space and relieve the tension pneumothorax.

**NOTE:** Most individuals have a chest wall thickness of at least 2 inches. A needle catheter unit shorter than 3.25 inches will not reach the pleural space, and should not be used. In studies, a 14 gauge, 3.25 inch needle catheter was as successful as a chest tube for relieving a tension pneumothorax. NCD can be as effective as a chest tube in casualties for up to four hours.

- 2) Antiseptic wipe
- 3) Tape (To secure the catheter hub to the chest)
- (c) Landmark - 2nd intercostal space, mid clavicular line, anterior chest, on the same side as the injury, directly over the third rib.
  - 1) Second intercostal space (ICS)
    - a) The 2nd ICS, MCL is between the second and third rib.
    - b) The first rib is located under the clavicle.



- 2) Mid clavicular line (MCL)
  - a) The clavicle extends into the shoulder joint.
  - b) Ensure placement is not medial to the nipple line. This may place the end of the needle in the inside of the cardiac box.
- 3) Directly over the top of the third rib
  - a) Directly under each rib is an artery, vein and nerve (neurovascular bundle).
  - b) Coming into contact with any of these structures would cause additional and unnecessary complications for the casualty.
- (d) Depth of the Needle
  - a) Needle is inserted all the way to the hub.
  - b) You may feel a pop and hear a rush of air escaping as you insert the needle.
  - c) Always continue to insert the needle/catheter all the way to the hub.
- (6) Transport to nearest treatment facility
  - (a) If the casualty is able, transport casualty in position of comfort, which is normally sitting up.
  - (b) If casualty is unable, transport casualty on his side or recovery position with injured side down.
- (7) Provide, if available:
  - (a) Pulse oximetry
  - (b) High flow oxygen
  - (c) Cardiac monitoring
- (7) Once the casualty arrives at a higher level of care a medical officer may decide a chest tube is necessary.

## **CHECK ON YOUR LEARNING**

What are the indications for needle chest decompression?

Why are the following characteristics important when performing needle chest decompression?

Using a 14 gauge needle and catheter, 3.25 inches in length

Placing the needle in the second intercostal space (ICS)

Using the mid clavicular line (MCL) as a landmark

Inserting the needle directly over the top of the third rib

How does NCD work?

## 2. Learning Step / Activity 2. Problem Solving Needle Chest Decompression

Method of Instruction: Lecture  
Instructor to Student Ratio: 1:60  
Time of Instruction: 10 mins  
Media: Large Group Instruction

### a. Reoccurrence of progressive respiratory distress

- (1) NCD will only be effective if the tension is being created by air (not blood) and the catheter remains unblocked.
- (2) If the patient has already received NCD once and begins to suffer from a reoccurrence of progressive respiratory distress, you should assume the needle is no longer relieving the tension and take action.
  - (a) If you have an additional supply of 14 gauge, 3.25" needle catheters, insert a second needle directly along side (laterally) of the first in an attempt to repeat the intervention.
  - (b) If you do not have a supply of 14 gauge, 3.25" needle catheters, flush the previously placed catheter with 1-2 ml of sterile IV solution.
    - 1) You will not cause additional harm to the casualty.
    - 2) 1-2 ml of fluid is a relatively small amount of the fluid.
    - 3) There will already be fluid in the space (blood).

### b. An appropriate needle catheter is not available to treat the tension pneumothorax.

- (1) Treat the open pneumothorax with an occlusive dressing.
- (2) Monitor casualty for progressive respiratory distress. If found, burp the wound by:
  - (a) Lift the edge of an occlusive to allow access the wound.
    - 1) This action alone may be enough to release the tension from the wound.
    - 2) If you hear air escape the wound and the casualty reports a relief, reseal the occlusive dressing to the wound.
    - 3) If tension remains, move on to the next step.
  - (b) Place a gloved finger into the wound.
  - (c) Reseal the occlusive dressing to the wound.

## CHECK ON YOUR LEARNING

What can you do if the casualty begins to develop progressive respiratory distress even after the wound has been dressing and an NCD has been give?

What is burping the wound?

3. Learning Step / Activity 3. Perform Needle Chest Decompression - Demonstration

Method of Instruction: Demonstration  
Instructor to Student Ratio: 1:15  
Time of Instruction: 25 mins  
Media: Large Group Instruction

The class is broken down into 4 groups. One instructor will lead one group through demonstration of the task 3 times in a row using the "Whole-Part-Whole" method. Please refer the Instructor Guidance section for additional information.

**Reference: DCMT approved Needle Chest Decompression skill sheet**

4. Learning Step / Activity 4. Perform Needle Chest Decompression - Practical Exercise

Method of Instruction: Practical Exercise (Hands-on)  
Instructor to Student Ratio: 1:6  
Time of Instruction: 1 hr 25 mins  
Media: Large Group Instruction

Combat Casualty Assessment scenarios are not used during this initial phase of skill training. Information below contains training minimums, additional sessions should be conducted based on the needs of the students. See Instructor Guidance for additional information. For all aspects of this practical exercise, student groups will be utilized.

- a. Imitation Session - no less than two imitation sessions per student
- b. Manipulation Session - no less than two manipulations session per student.
- c. Precision Session - The following drills may be completed based on the time allotted. A minimum of one precision session should be completed per student.
  1. Speed drills
  2. Low light skill attempts
  3. Blind folded intervention attempts (only to be completed with new, sterile needles).

5. Learning Step / Activity 5. Optional Student Homework

Method of Instruction: Study Assignment  
Instructor to Student Ratio: 1:445  
Time of Instruction: 0 hrs  
Media: Large Group Instruction

1. During the care under fire phase of your patient treatment, you notice that your patient is having problems breathing. At what point do you treat any thoracic injuries that your casualty may have?
  - a. Immediately when they are found
  - b. Immediately when you begin the tactical field care phase of care
  - c. Immediately during the breathing portion of the tactical field care phase of care**
  - d. Immediately during the airway portion of the tactical field care phase of care**Page 4, b (5) (d)**
2. Your casualty has increased respiratory distress after his sucking chest wound was treated with an occlusive dressing. What is the probable cause of his respiratory distress?
  - a. A build up of air between the pleural fluid and the visceral fluid
  - b. Surface tension created by the pleural fluid
  - c. Decreased diaphragm and intercostals muscle contraction
  - d. A build up of air between the visceral and parietal pleural****Page 6, a (1)**
3. After you determine what the cause of your patient's increased respiratory distress is a tension pneumothorax, what treatment do you want to give to your patient?
  - a. Place an occlusive dressing on the patient's sucking chest wound

- b. **Perform a needle chest decompression**
- c. Check for other open chest wounds
- d. Place a gloved hand over the open chest wound

**Page 12, (5) (a)**

4. You determine that you must perform a needle chest decompression on your patient that is in respiratory distress. Why must the catheter used for needle chest decompression be 14 gauge and 3.25 inches in length?
  - a. **A needle catheter unit shorter than 3.25 inches may not reach the pleural space**
  - b. NCD can be as effective as a chest tube in casualties for up to four hours
  - c. NCD is a stop gap measure for tension pneumothorax until the casualty reaches the MTF
  - d. Surgical intervention may be necessary

**Page 12 Note**

5. While still in the tactical field care phase of your treatment phase, your patient has a reoccurrence of increased respiratory distress after you have already performed a needle chest decompression. What treatment does your patient need?
  - a. Insertion of a chest tube
  - b. **A second 14 gauge, 3.25 inch needle inserted directly next to the first one**
  - c. Nothing, you have already performed a needle chest decompression
  - d. Continue to monitor the patient

**Page 14 a (2) (a)**

**SECTION IV. SUMMARY**

Method of Instruction: <u>Lecture</u> Instructor to Student Ratio is: <u>1:60</u> Time of Instruction: <u>5 mins</u> Media: <u>Large Group Instruction</u>
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**Check on Learning**

- (1) What thoracic injuries are associated with penetrating or blunt trauma?
- (2) Identify the signs and symptoms of a chest injury.
- (3) What are the immediate life-threatening thoracic injuries? How should the medic management those injuries?
- (4) What are potential life-threatening thoracic injuries? What preventive steps should the medic take to ensure the injuries do not become life threatening?

**Review / Summarize Lesson**

In multiple trauma casualties, chest injuries are common and many times are considered life threatening. You must have the ability to identify the injury while performing the primary survey and appropriately treat the injury to salvage the casualty.